2003 Guide to Courses in GIS and Land-Related Studies

on the Twin Cities Campus University of Minnesota

by Margaret R. Wolfe

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Introduction

GIS is an acronym that originally stood for *geographic information systems,* but the term *systems* implied a strict technology focus. Now GIS represents *geographic information science,* the broad multidisciplinary field that covers the many technologies and disciplines involved in spatial research and education.

GIS was pioneered at the University of Minnesota 30 years ago with the development of EPPL software and a computer-generated wall map showing statewide land use in 1969. That research project involved faculty and graduate students from many fields.

Because many disciplines are involved, it is difficult to know about all of the courses offered at the Twin Cities campus that are related to GIS. This updated course guide, based on the semester system, was developed by CURA to aid faculty and students in locating courses that (1) use or study GIS technology or (2) provide the concepts and disciplinary tools essential for using GIS technology wisely—courses on topics such as land use planning and resource economics.

There are 18 departments listed in this new guide and contact information is provided for a person in each department who

can give further information about the department's offerings. Instructors can also be contacted directly. For each of the courses, the following information is listed: number and title, number of credits, prerequisites, course description, instructors' names, and semesters offered.

Individual departments provided the best information available at the time they were contacted in Spring 2003. For information current at the time you use this guide, check the University of Minnesota class schedules. Additional information is also available for many courses in the University *Course Guide* issued each semester.

CURA will attempt to keep this guide updated with information provided by the listed departments. Please contact Will Craig with courses that may have been overlooked or with updated information on courses already listed.

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Symbols

The following symbols are used in this course guide:

 # Approval of the instructor is required for registration
¶ Concurrent registration is required (or allowed) in the course listed after this symbol

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Courses Listed by Department

APPLIED ECONOMICS

College of Agricultural, Food, and Environmental Sciences
231 Classroom Office Building, 612-625-1222
http://www.apec.umn.edu

Contact: Frances R. Homans
217F Classroom Office Building
612-625-6220, homan004@umn.edu

ApEc 5611. Economic Aspects of Environmental Management. (3 cr; prereq [Sr or grad student] in [biological science or conservation biology or ecology or fisheries or forestry or public affairs or water resources or wildlife conservation] or CLA or #; A-F only)
Economist approach to environmental problems such as water/air pollution. Application of supply/demand concepts to evaluation of environmental resources. Methods of evaluation. Analysis of pollution control policies from economic point of view.

Instructor: Naomi Zeitouni
Semesters offered: Spring 2004

ApEc 8601. Natural Resource Economics. (3.0 cr; prereq Econ 8004 or Econ 8104 or #)
Economic analysis of resource use and management. Capital theory and dynamic resource allocation; applications to renewable and nonrenewable resources; empirical studies and policy issues.

Instructor: Frances R. Homans
Semesters offered: Fall

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ARCHITECTURE

College of Architecture and Landscape Architecture
145 Rapson Hall, 612-624-7866
http://www.cala.umn.edu/

Contact: Nancy A Miller
145 Rapson Hall
612-624-3739, nmiller@umn.edu

Arch 5711. Design Principles of the Urban Landscape. (3 cr; prereq Arch or BED major or M Arch or LA grad major or #; A-F only)
Art and design of creating city, neighborhood, and development plans. Public policies, planning tools and process, and physical models used by design professionals and private and civic institutions to shape the physical environment.

Instructor: Nancy A. Miller
Semesters Offered: Spring

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ART HISTORY

College of Liberal Arts
338 Heller Hall, 612-624-4500
http://www.arthist.umn.edu/

Contact: Frederick Cooper
421 Heller Hall
612-625-2325, fcooper@umn.edu

ARTH 3340/5340. Practicum in Archaeological Field and Computer Techniques. (3 cr; prereq ClCv major or # or 1 course in ancient art and archaeology)
This is an opportunity to master basic skills that range across disciplines: the humanities, civil engineering and surveying, and natural and physical sciences. The Practicum serves as a prerequisite for participation in one of several U of M projects in Greece or Minnesota, and is open to undergraduate and graduate students. Also appropriate training for other excavations. Course is a mixture of readings in archaeology and professional surveying, combined with digs at a local site. (These courses may be taken through Art History [ARTH], Classical and Near Eastern Studies [CNES], or Classical Civilization [CLCV].)

Instructor: Frederick Cooper
Semesters Offered: varies

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CIVIL ENGINEERING

Institute of Technology
122 Civil Engineering, 612-625-5522
http://www.ce.umn.edu

Contact: Randal J. Barnes
122 Civil Engineering
612-625-5828, barne003@umn.edu

CE 3111. CADD for Civil Engineers. (2 cr; prereq 3201; A-F only)
Introduction to AutoCAD and land development desktop software. Students complete all tasks to design two-lane roadway using civil engineering design software, including topography, plan/profile, contours, cross sections, and quantity calculations

Instructor: Anne Johnson
Semesters offered: Fall, Spring

CE 3202. Surveying and Mapping. (2 cr; prereq IT or #; Math 1271, 1272; A-F only)
Theory of precision measurements of distance, elevation, angle, and direction of points and lines above, on, or beneath the earth's surface; establishing such points or lines. Elements of coordinate systems, datum planes, and maps.

Instructor: Staff
Semesters offered: Fall, Spring

CE 4341. Engineering Geostatistics. (3 cr; prereq CE, GeoE or upper div Geo or grad, Stat 3021 or #; A-F only)

Problem solving and decision making in civil and geological engineering using applied statistics. Emphasizes spatially correlated data, e.g., geologic site characterization, spatial sampling design.

Instructor: Randal J. Barnes
Semesters offered: Spring

CE 4352. Groundwater Modeling. (3 cr; prereq Upper div IT or grad, CE 4351, GeoE 4351 or #; A-F only)
Analytic element method. Mathematical and computer modeling of single and multiple aquifer systems. Field problems. Theory and application of contaminant transport models, including capture zone analysis.

Instructor: Otto Strack
Semesters offered: Spring

CE 4501. Hydrologic Design. (4 cr; prereq 3502; A-F only)
Hydrologic cycle: precipitation, evaporation, infiltration runoff. Flood routing through rivers and reservoirs. Statistical analysis of hydrologic data and estimation of design flows. Open channel flow, flow through conduits. Detention basin design, hydraulic structure sizing, estimation of risk of flooding.

Instructor: Efi Foufoula, staff
Semesters offered: Fall, Spring

CE 8506. Stochastic Hydrology. (4 cr; prereq Stat 3021 or equiv or #; A-F only)
Analysis and synthesis of hydrologic series and systems; derived distributions; uncertainty and risk analysis; flood frequency analysis; multivariate time series analysis; correlation and spectral analysis; series of long-range dependence; linear estimation; geostatistics; sampling networks; hydrologic forecasting.

Instructor: Efi Foufoula
Semesters offered: Varies

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COMPUTER AND INFORMATION SCIENCES

Institute of Technology
4-192 Electrical Engineering/Computer Science, 625-4002
http://www.cs.umn.edu

Contact: Shashi Shekhar
5-203 Electrical Engineering/Computer Science
612-624-8307, shekhar@cs.umn.edu

CSci 4041. Algorithms and Data Structures. (4 cr; prereq 3311 and 3321; prereq 1902 and 2011 or #; no cr for grads in CSci)
Rigorous analysis of algorithms and their implementation. Algorithm analysis, sorting algorithms, binary trees, heaps, priority queues, heapsort, balanced binary search trees, AVL trees, hash tables and hashing, graphs, graph traversal, single source shortest path, minimum cost spanning trees.

Instructor: Various faculty
Semesters offered: Every semester

CSci 4107. Introduction to Computer Graphics Programming. (3 cr; Credit will not be granted if credit has been received for: CSCI 5107; prereq 4041 or #; cannot be taken for grad CSci cr)
Theory/practice of computer graphics programming using C/C++ and OpenGL. Practical concepts in computer graphics modeling, rendering, and animation. Emphasizes effective use of graphics toolkits.

Instructor: Various graphics faculty
Semesters offered: Once a year, usually Spring

CSci 4211. Introduction to Computer Networks. (3 cr; Credit will not be granted if credit has been received for: CSCI 5211; prereq 4061 or #; basic knowledge of [computer architecture, operating systems] recommended, cannot be taken for grad CSci cr)
Concepts, principles, protocols, and applications of computer networks. Layered network architectures, data link protocols, local area networks, routing, transport, network programming interfaces, networked applications. Examples from Ethernet, Token Ring, TCP/IP, HTTP, WWW.

Instructor: Various faculty

Semesters offered: Every semester

CSci 4707. Practice of Database Systems. (3 cr; Credit will not be granted if credit has been received for: CSCI 5707, INET 4707; prereq 4041 or #)
Concepts, conceptual data models, case studies, common data manipulation languages, logical data models, database design, facilities for database security/integrity, applications.

Instructor: Various faculty
Semesters offered: Every semester

CSci 5107. Fundamentals of Computer Graphics 1. (3 cr; Credit will not be granted if credit has been received for: CSCI 4107; prereq [4041 or instr consent], fluency in C/C++, mastery of basic concepts in linear algebra)
Fundamental algorithms in computer graphics. Emphasizes programming projects in C/C++. Scan conversion, hidden surface removal, geometrical transformations, projection, illumination/shading, parametric cubic curves, texture mapping, antialising, ray tracing. Developing graphics software, graphics research.

Instructor: Various graphics faculty
Semesters offered: At least once a year, usually Fall

CSci 5115. User Interface Design, Implementation and Evaluation. (3 cr; prereq 3322; prereq 4041 or #)
Theory, design, programming, and evaluation of interactive application interfaces. Human capabilities and limitations, interface design and engineering, prototyping and interface construction, interface evaluation, and topics such as data visualization and World Wide Web. Course is built around a group project.

Instructor: Joseph A. Konstan
Semesters offered: Fall

CSci 5211. Data Communications and Computer Networks. (3 cr: Credit will not be granted if credit has been received for: CSCI 4211; prereq [4061 or #], basic knowledge of [computer architecture, operating systems, probability])
Fundamental concepts, principles, protocols, and applications of computer networks. Layered network architectures, data link protocols, local area networks, network layer/routing protocols, transport, congestion/flow control, emerging high-speed networks, network programming interfaces, networked applications. Case studies using Ethernet, Token Ring, FDDI, TCP/IP, ATM, Email, HTTP, and WWW.

Instructor: Various faculty
Semesters offered: Every semester

CSci 5421. Advanced Algorithms and Data Structures. (3 cr; prereq 3322; 4041 or #)
Fundamental paradigms of algorithm and data structure design. Divide-and-conquer, dynamic programming, greedy method, graph algorithms, amortization, priority queues and variants, search structures, disjoint-set structures. Theoretical underpinnings. Examples from various problem domains.

Instructor: Ravi Janardan
Semesters offered: Fall

CSci 5707. Principles of Database Systems. (3 cr; Credit will not be granted if credit has been received for: CSCI 4707, INET 4707, prereq 4041 or #)
Concepts, database architecture, alternative conceptual data models, foundations of data manipulation/analysis, logical data models, database designs, models of database security/integrity, current trends.

Instructor: Various faculty
Semesters offered: Every semester

CSci 8442. Computational Geometry and Applications. (3 cr; prereq 5421 or #)
Designing efficient algorithms and data structures for geometric problems. Models of computation, convex hulls, geometric duality, multidimensional search, Voronoi diagrams and Delauney triangulations, linear programming in fixed dimensions, lower bound techniques. Applications, advanced topics.

Instructor: Unknown
Semesters offered: When feasible

CSci 8715. Spatial Databases. (3 cr; prereq 4707 or 5707 or GIS 5571 or GIS 5573)
Motivation, models of spatial information, querying spatial data, processing strategies for spatial queries, multi-dimensional storage/access methods, spatial graph datasets, spatial data mining, trends (e.g., spatio-temporal databases, mobile objects, raster databases).

Instructor: Shashi Shekhar

Semesters offered: Spring 2004

CSci 8725. Databases for Bioinformatics. (3 cr; prereq 4707 or 5707 or #)
DBMS support for biological databases, data models. Searching integrated public domain databases. Queries/analyses, DBMS extensions, emerging applications.

Instructor: John Carlis
Semesters offered: TBD, probably 2004–05 and alternate years

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DESIGN, HOUSING, AND APPAREL

College of Human Ecology
240 McNeal Hall, 612-624-9700
http://www.che.umn.edu/depts/#DHA

Contact: Jeff Crump
350 McNeal Hall
612.624.2281, jrcrump@che.umn.edu

DHA 5469. Understanding Housing: Assessment and Analysis. (3 cr, prereq DHA 2463 or permission)
This course will develop an understanding of how housing research problems are formulated and how information pertaining to housing characteristics and conditions is analyzed and presented. The course is organized into three main sections. (1) a broad look at what research is, how research questions can be formulated, and how to approach the writing and analysis necessary to successfully complete housing-related research, (2) an examination of characteristics and types of data commonly used in housing-related research, and (3) a focus on data analysis and presentation, particularly the cartographic analysis of housing characteristics and conditions. Though there will be some instruction in basic GIS operations, the focus will be on maps as communication devices.

Instructor: Jeff Crump
Semesters offered: Spring every year

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ECOLOGY, EVOLUTION, AND BEHAVIOR

College of Biological Sciences
100 Ecology Building, 612-625-5700
http://biosci.cbs.umn.edu/eeb

Contact: Anthony Starfield
306 Ecology Building
612-625-5721, starf001@umn.edu

EEB 4016. Ecological Biogeography. (3 cr; prereq Biol 3407)
Biotic regions of the world in general and North America in detail. Ecological principles of distribution, interpretations of regional and temporal patterns in distribution of vegetation, and taxonomic groups of plants and animals. Includes one weekend field trip.

Instructor: Edward J. Cushing
Semesters offered: Spring (offered alternate years)

EEB 5961. Decision Analysis and Modeling in Conservation Biology. (3 cr; prereq Grad student or #; A-F only)
Decision analysis/modeling in conservation biology. Techniques, concepts, software.

Instructor: Anthony Starfield
Semesters offered: Spring every year

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FOREST RESOURCES/NATURAL RESOURCES AND ENVIRONMENTAL STUDIES

College of Natural Resources:
115 Green Hall, 624-3400
http://www.cnr.umn.edu/FR/

Contact: Marvin Bauer
115 Green Hall
612-624-3703, mbauer@umn.edu

FR 3131/5131. Geographical Information Systems for Natural Resource Analysis. (4 cr, A-F only)
Introduction to GIS. Focuses on natural resources. Data structures, sources, collection, and quality. Lab exercises introduce geodesy, map projections, spatial analyses, and cartographic modeling.

Instructor: Paul Bolstad, Andrew Jenks
Semesters offered: Fall, Spring

FR 3262/5262. Remote Sensing of Natural Resources and Environment. (4 cr)
Principles and techniques of remote sensing and its applications to mapping and monitoring environmental, land and water resources from local to global scales. Lab provides hands-on experience working with aerial photography and digital sensing imagery.

Instructor: Marvin Bauer
Semesters offered: Spring

FR 5412. Digital Remote Sensing. (3 cr; prereq 3262 or 5262 or grad student or #)
Physical basis and practical applications of digital remote sensing. Energy-matter interactions. Measurements and sensors. Digital image processing/analysis. Experience working with remote-sensing data, image processing, and models.

Instructor: Marvin Bauer
Semesters offered: Fall

NRES 4295W. GIS in Environmental Science and Management. (4 cr; prereq FR 3131 or #, A-F only, meets CLE Writing Intensive req)
Application of spatial data inventory/analysis in complex environmental planning problems. Spatial data collection, database development methods, including GPS, DLG, TIGER, and NWI data, and spatial analysis.

Instructor: Paul Bolstad
Semesters offered: Fall

NRES 5295. GIS in Environmental Science and Management. (4 cr; prereq grad student or #)
Application of spatial data inventory/analysis in complex environmental planning problems. Spatial data collection. Database development methods, including GPS, digital photography, and other digital data, spatial analysis, and a final report. Topics vary by year.

Instructor: Paul Bolstad
Semesters offered: Fall

FR 5615. Field Remote Sensing and Resource Survey. (2 cr; prereq 3218, 3262)
Field applications of remote sensing, sampling/measurement methods to inventory/mapping of forest and other natural resources. Offered at Cloquet Forestry Center.

Instructors: Marvin Bauer, Alan Ek
Semesters offered: May Session

NRES 3211/5211. Survey, Measurement, and Modeling for Environmental Analysis. (3 cr, 3211 prereq [Math 1142 or Math 1271], [Stat 3011 or FW 4001]; 5211 prereq grad student or #)
Introduction to survey, measurement, and modeling concepts and methods for study of natural resources and environmental issues. Emphasis on survey design for data collection, estimation, and analysis for variables and issues encompassing land, water, air, vegetation, animal, soil, and human or social variables.

Instructor: Alan Ek
Semesters offered: Spring

FR 5228. Advanced Assessment and Modeling. (3 cr, prereq 3218, Math 1272, Stat 5021)
Application of recently developed mathematics, computer science, and statistics methodologies to natural resource functioning, management, and use problems. Specific topics, software, and methodologies vary.

Instructor: Thomas Burk

Semesters offered: Fall

FR 8205. Research Problems: Spatial Data Analysis. (1-5 cr; prereq #)
Independent research on GIS or remote sensing under faculty guidance.

Instructor: Marvin Bauer, Paul Bolstad
Semesters offered: Fall, Spring, Summer

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GEOGRAPHY

College of Liberal Arts
414 Social Sciences, 612-625-6080
http://www.geog.umn.edu

Contact: Francis J. Harvey
414 Social Sciences
612-625-2586, fharvey@umn.edu

Geog 3361. Land Use, Landscapes, and the Law. (3 cr)
Landscapes are political statements. They reflect how individuals, organizations, and governments have exercised the legal rights that they possess to produce goods and provide services.

Instructor: Roderick H. Squires
Semesters offered: Fall every year

Geog 3511. Principles of Cartography. (4 cr; prereq 3 cr in geog or #)
History and development of U.S. academic cartography, coordinate systems and map projections, data classification and map generalization, methods of thematic symbolization, and cartographic design. A series of computer-based lab exercises will apply conceptual lecture material to the creation of thematic maps.

Instructors: Robert B. McMaster, Mark B. Lindberg
Semesters offered: When feasible

Geog 3531. Numerical Spatial Analysis. (4 cr; Credit will not be granted if credit has been received for: GEOG 5531)
Introduction to theoretical and applied aspects of geographical quantitative methods with a focus on spatial analysis. Emphasis placed on the analysis of geographical data for spatial problem solving in both the human and physical areas of the discipline.

Instructor: Richard Skaggs
Semesters offered: Fall

Geog 3561/5561. Principles of Geographic Information Science. (4 cr; prereq Jr or sr)
Introduction to study of geographic information systems (GIS) for geography and non-geography students. Topics include GIS application domains, data models and sources, analysis methods, and output techniques. Lectures, readings, and hands-on experience with GIS software.

Instructors: Steven M. Manson
Semesters offered: Fall every year

Geog 5361. Geography and Real Estate. (4 cr)
Origins and evolution of land ownership in the United States.

Instructor: Roderick H. Squires
Semesters offered: Spring every year

Geog 5371. American Cities I: Population and Housing. (4 cr; prereq 5201)
Emergence of North American cities; residential building cycles, density patterns; metropolitan housing stocks, supply of housing services; population and household types; neighborhood-level patterns of housing use; housing prices; intraurban migration; housing submarkets inside metro areas; emphasis on linking theory, method, case studies.

Instructor: John S. Adams
Semesters offered: Fall every year

Geog 5372. American Cities II: Economy, Land Use and Transportation. (4 cr; prereq PA 5202; A-F only)

Urban economy and its locational requirements; central place theory; transportation and urban land use, patterns, and conflicts; industrial and commercial land blight; real estate redevelopment; historic preservation; emphasis on links between land use, transportation policy, economic development, and local fiscal issues; U.S.-Canadian contrasts.

Instructor: John S. Adams
Semesters offered: Spring every year

Geog 5511. Advanced Cartography. (3 cr; prereq 3511 or #)
Advanced topics on data sources for mapping; history of thematic cartography (focused on 19th-century European activity); multivariate classification and symbolization; models for cartographic generalization, spatial interpolation, and surface representation; principles of animated and multimedia cartography.

Instructor: Robert B. McMaster
Semesters offered: Spring 2004 and alternate years

Geog 5512. Cartography: Topics. (3 cr; prereq 3511 or 3531 or #)
Selected topics include the system of cartographic communication, map design, map reading, map analysis, history of cartography.

Instructors: Robert B. McMaster, Mark B. Lindberg
Semesters offered: When feasible

Geog 5530. Cartography Internship. (2-7 cr [max 10 cr]; prereq #; S-N only)
This internship provides intensive hands-on experience in contemporary map production and design—ranging from GIS applications to digital prepress. Strong computer skills are essential.

Instructor: Staff
Semesters offered: When feasible

Geog 5531. Numerical Spatial Analysis. (4 cr; Credit will not be granted if credit has been received for Geog 3531)
Applied/theoretical aspects of geographical quantitative methods for spatial analysis. Emphasizes analysis of geographical data for spatial problem solving in human/physical areas.

Instructor: Richard Skaggs
Semesters offered: Fall

Geog 5561. Principles of Geographic Information Science. (4 cr; prereq Jr or sr)
Introduction to study of geographic information systems (GIS) for geography and non-geography students. Topics include GIS application domains, data models and sources, analysis methods, and output techniques. Lectures, readings, and hands-on experience with GIS software.

Instructors: Steven M. Manson
Semesters offered: Fall every year

Geog 5562. Geographic Information Science and Analytical Cartography. (3 cr; prereq 3561 or 5561 and 3511; or #)
Topics include algorithms and data structures for digital cartographic data, topological relationships, surface modeling and interpolation, map projections and geometric transformations, numerical generalization, and raster and vector processing. Hands-on experience using a variety of software packages.

Instructor: Steven M. Manson
Semesters offered: Fall every year

Geog 5563. Advanced Geographic Information Science. (3 cr; prereq B or better in 3561 or 5561 or #)
Advanced study of geographic information systems (GIS). Topics include spatial data models, topology, data encoding, data quality, database management, spatial analysis tools, and visualization techniques. Hands-on experience using an advanced vector GIS package.

Instructors: Francis J. Harvey
Semesters offered: Spring every year

Geog 5564. Urban Geographic Information Science and Analysis. (3 cr; prereq 3561 or 5561)
Core concepts in urban geographic information science including sources for urban geographical and attribute data (including census data), urban data structures (focusing on the TIGER data structure), urban spatial analyses (including location-allocation models), geodemographic analysis, network analysis, and the display of urban data.

Instructors: Robert B. McMaster, William J. Craig

Semesters offered: Spring 2001 and alternate years

Geog 5565. Geographical Analysis of Environmental Systems and Global Change. (3 cr; prereq 3561 or 5561 or FR 3131 or LA 5573 or one intro GIS course or grad student or #)
Applications of geographic information systems and other spatial analysis tools to the analysis of environmental systems patterns, dynamics, and interactions. Focus on global to landscape databases developed to analyze atmospheric, hydrospheric, geomorphic, pedologic, biologic, and human land-use systems.

Instructor: Steven M. Manson
Semesters offered: Spring every year

Geog 8290. Seminar: Geographic Information Systems (GIS) and Cartography. (3 cr; prereq #)
Selected concepts and methods. Topics, which vary yearly, include spatial analysis methods in GIS; advanced visualization methods; data quality and error propagation in GIS; generalization methods in GIS and cartography; role of time in GIS; interactive and animated cartography; incorporation of uncertainty.

Instructors: Robert B. McMaster, Francis J. Harvey
Semesters offered: When feasible

Geog 8291. Seminar: Geographic Information Systems (GIS), Technology, and Society. (3 cr; prereq #)
Relationships between practice of GIS and political, economic, legal, and institutional structures of society; effects of GIS on society; nontraditional spaces in GIS; GIS and local decision making; privacy issues.

Instructors: Francis J. Harvey
Semesters offered: Fall 2003 and alternate years

Geog 8292. Seminar: Seminar in GIS, Spatial Analysis & Modeling.
GIS, spatial analysis, and modeling are means by which one can explore human and environmental systems. This is an intensive seminar that provides an overview of these fast changing, broad areas through reading and applications. It is also designed to guide graduate students in thesis and dissertation research by giving two-person teams the opportunity to explore one or two topics in greater detail for presentation in a seminar and giving individual students the opportunity to focus on one topic exclusively through a research application. This course expands on aspects of GIS, statistics, and modeling covered by Geog 3511 and Geog 3561/5561 and gives students the opportunity to explore theory and skills learned in 5xxx-level courses.

Instructor: Steve M. Manson
Semesters offered: Spring 2004 and alternate years

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GEOGRAPHIC INFORMATION SCIENCE GRADUATE PROGRAM

Administered by Department of Geography
College of Liberal Arts
414 Social Sciences, 612-624-1498
http://www.geog.umn.edu/Graduate/MGIS/index.html

Contact: Susanna McMaster
414 Social Sciences
612-625-9883, smcmaster@atlas.socsci.umn.edu

The objectives of the master's program in Geographic Information Science are to provide a comprehensive GIS degree that balances work in the theoretical/conceptual aspects of GIS as well as the technical and applied sides. Societal impacts of GIS technologies will be emphasized throughout the curriculum. Courses will be offered at times conducive for students who are employed—in the evening, early morning, or late afternoon. Completion of 35 credits is required, with 20 credits in core and technology, 9 credits of electives, and 6 credits of applied project (GIS 8990). A minimum of 6 credits must be taken outside of the Department of Geography.

Courses for Students in GIS Graduate Program (open to other graduate students as space permits)

GIS 5571. Introduction to Arc/Info. (3 cr; prereq Geog 5561 or equiv, status in MGIS program, familiarity with computer operating systems or #)
The course focuses on six basic themes: data capture; geometric transformations and map projections; topology; data editing; database management; and map production. Students will use the UNIX This course provides an introduction to

Arc/Info, one of the "industry standard" GIS packages. Version of ArcGIS workstation and Windows NT versions of ArcGIS desktop and ArcGIS workstation in weekly lecture/lab sessions.

Instructor: Mark B. Lindberg
Semesters offered: Fall every year

GIS 5572. Advanced Arc/Info. (3 cr; prereq 5571, Geog 5561 or equiv, status in MGIS program or #)
This is an advanced course in Arc/Info, and has three main components: in-depth exploration of the six themes emphasized in GIS 5571; extension into selected areas (e.g., dynamic segmentation, grid processing, address matching, data exchange, large-scale projects, spatial statistics); and macro language programming. Students completing this course will be able to work independently at an advanced level in Arc/Info.

Instructor: Mark B. Lindberg
Semesters offered: Spring every year

GIS 5573. Desktop Mapping. (1.5 cr; prereq Geog 5561 or equiv, Geog 3511 or equiv, status in MGIS program or #)
This course provides an introduction to desktop mapping systems (such as ArcGIS). These systems are rapidly being adopted for use in business, marketing, socio-demographic analysis, and other areas. Students will develop an appreciation for the general capabilities of desktop mapping software through a series of lab exercises based on existing spatial and attribute databases.

Instructor: Catherine Hansen
Semesters offered: Fall every year

GIS 5574. GIS and the Internet. (1.5 cr; prereq Geog 5561 or equiv, status in MGIS program or #)
This course focuses on the role of the Internet in GIS applications. The goal is to provide students with a basic introduction to the Internet as it pertains to GIS, and to provide information about specific Internet resources useful for GIS applications. Topics include: the Internet as a data source; the role of the Internet in disseminating information on GIS activities and programs; the capabilities of the Internet for interactive mapping applications; and issues associated with the development of GIS-based Web sites. Students who complete this course will have a broad understanding of the ways in which the Internet is impacting GIS data access and use. The course involves hands-on development of a Web site, so experience in authoring HTML is useful and strongly recommended.

Instructor: Steve Lime
Semesters offered: Fall

GIS 5575. Surveying and the Global Positioning System (GPS). (2 cr; prereq Geog 5561 or equiv, status in MGIS program or #)
This course provides an introduction to surveying and mapping techniques of use to GIS professionals, including the Global Positioning System (GPS). Topics include: basic traditional survey methods, including horizontal and vertical location techniques; geodesy; data adjustments; datums and ellipsoids; coordinate systems; and transformations. GPS is a substantial part of the course.

Instructor: David Zenk
Semesters offered: Spring

GIS 5577. Spatial Data Administration. (3 cr; prereq Geog 5561, Geog 5563 or equiv, status in MGIS program, familiarity with computer operating systems or #)
This course prepares students for professional tasks that require administration of spatial databases. Technical topics include: database design; data quality; data maintenance; and technical documentation. Strategic topics include: the role of geographic information within organizations; costs and benefits involved in database administration; and database development project management. The course emphasizes sound database administration procedures in the effective functioning of an organization.

Instructor: Robert Maki
Semesters offered: Spring

GIS 5590 (5578 starting Spring 2004). GIS Programming. (2 cr; prereq #)
This course exposes students to the opportunities and flexibility that computer programming can offer to the application of GIS technologies. It introduces basic object-oriented programming techniques using Microsoft's Visual Basic programming language. Students will apply GIS principles and concepts within Visual Basic programs using ESRI's MapObjects.

Instructor: Tim Loesch
Semesters offered: Spring

MGIS Seminars

GIS 8501 Survey of GI Science: Past, Present and Future Trends and Activities. (3 cr; prereq MGIS student or #)
This course reviews major trends and activities in the discipline of geographic information science. We will examine key GIS initiatives and activities at the university, local, state, and federal-level scales as well as in the government, education, and private industry sectors. Additionally, a survey of the history of GIS and its relationship to cartography and other disciplinary areas will be covered. A variety of teaching techniques will be used including active learning methods, multimedia use, and guest speaker presentations. The three main objectives of the course are (1) to provide students with a sense for the state of GI Science, (2) to provide students with guidance in planning their degree program and capstone project, and (3) to build community among the entering groups of MGIS students through the exploration of key trends in the field.

Instructor: Susanna McMaster
Semesters offered: Fall

GIS 8990 Capstone Seminar. (2-6 cr; prereq MGIS, #; A-F only)
This seminar-style course focuses on the development of individual students' capstone projects. Students will develop a plan in consultation with the instructor for what they will accomplish by the end of the term and be responsible for giving weekly progress reports. The course will cover the following topics relating to basic aspects of developing a capstone project including discussing the nature of the capstone project, proposal writing, preparing drafts of the capstone paper including the literature review and methodology, preparing for the oral examination including PowerPoint presentation development, and preparing for conference presentations and posters including large format poster development. In addition to feedback from the course instructor, various MGIS faculty will be invited to participate in select meetings to provide feedback to student progress reports.

Instructor: Susanna McMaster
Semesters offered: Spring

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INFORMATION AND DECISION SCIENCES

Carlson School of Management
IDS Department, 3-365 CSOM, 612-624-8030
http://www.csom.umn.edu/Page1447.aspx

Note: *Carlson School of Management (CSOM) courses are restricted to CSOM students and students in other approved, business-related majors. Other students may be able to enroll with special permission during open enrollment if space is available, but must file a petition at the Carlson MBA office, 2-210 Carlson. Under current policy in the Information and Decision Sciences department, no courses can be audited or taken S-N.*

Contact: Fred Riggins
3-370 Carlson School of Management
612-624-5760, friggins@csom.umn.edu

IDSc 6040. Information Technology Management. (2 cr, 7- week course; no prerequisites)
Overview of the management of information systems and information technology in today's global organization, including strategic uses of IT, alignment of IT and organizational strategy, Internet and Web technologies, e-commerce customer services, integration of e-business applications, interorganizational systems, systems implementation, and management of information as a resource. Taught using a combination of lecture, case analysis, and classroom discussion within the context of issues related to organizational, strategic and economic impacts of information systems on the functional areas of business. Students do not need a background in IT.

Instructor: Fred Riggins, Mani Subramani
Semesters offered: Spring

IDSc 6050. Information Technologies and Solutions. (2 cr, 7- week course; no prerequisites)
In-depth coverage of selected advanced technologies and solutions that are critical to the process of evaluating opportunities and creating strategic advantage. Technologies covered may change; examples include data warehousing, data mining, CRM, ERP, XML, wireless. The course will cover each topic from three different but interrelated perspectives: fundamental knowledge to create a normative base; business applications, will include contextual applications via create short cases; commercial solutions, will overview the features and capabilities of commercial software implementations. Students are expected to have IT education/experience such as CS or IS.

Instructor: Alok Gupta, Gedas Adomavicius
Semesters offered: Spring

IDSc 6201. Information Systems Development: Methodologies and Tools. (2 cr, 7- week course; prereq IDSc 6040 or IDSc 6050)
Comprehensive treatment of the technologies and environment associated with large-scale information systems development. Topics include relational and O-O DBMS; overview of visual, graphical, object, and procedural systems development languages; development of effective user interfaces; application of CASE tools; overview of hardware, operating systems, and networks.

Instructor: Gedas Adomavicius, Luis Sison
Semesters offered: Fall and Spring

IDSc 6202. Information Systems Development: Planning and Analysis. (2 cr; 7-week course; prereq IDSc 6040 or IDSc 6050)
In-depth coverage of methodologies, concepts, and techniques. Topics include conformance to existing plans and policies; problem formulation and prioritization; economic rationale, justification, and risk assessment of systems development projects; make vs. buy decisions, IS acquisition, outsourcing, and vendor selection; establishing information requirements in an enterprise-wide context; specification of application systems requirements in conjunction with end-users; verification of system requirements; project management tools and techniques.

Instructor: Weidong Xia, Luis Sison
Semesters offered: Fall and Spring

IDSc 6431. Advanced Database I. (2 cr; 7- week course, prereq 6201, MBA student; A-F only)
Data modeling; Entity-Relationship (ER) modeling and diagramming; relational database design and normalization; introduction to Object-Role Modeling (ORM)—basic constructs and constraints. Data(base) administration—role and functions and organizational arrangements; data planning; high-level database operations in data manipulation languages—SQL, and the new ANSI SQL 1999 standard; facilities of a comprehensive DBMS; the DBMS marketplace. Students do hands-on work with MS SQL Server DBMS and MS Visio for Enterprise Architects (VEA) ORM data modeling tool (software supplied and also available in the computer labs). *[**Note:** IDSc 6431 and IDSc 6432 can be considered as the sequence Database I and Datebase II. This is an update to what is currently listed in the course catalogues. Students are strongly urged to take both 7-week courses because IDSc 6432 provides the opportunity for hands-on working of problems and the solidification of concepts learned in 6431.]*

Instructor: Gordon C. Everest
Semesters offered: Spring

IDSc 6432. Advanced Database II. (2 cr; 7 week course, prereq [6431], MBA student; A-F only)
Continuing in-depth exploration of object role modeling with several exercises; modeling with subtypes and supertypes; validation and presentation of a data model; conducting data modeling projects; capturing business rules; mapping an ORM data model to a relational database; queries on an ORM data model. Examination of other data languages—XML and UML, database performance tuning; data storage architectures and management; temporal, spatial, and multimedia databases; data warehousing and OLAP; Object-Oriented DBMS, databases in a distributed environment; data security and privacy. Students do hands-on work with MS SQL Server DBMS and MS Visio for Enterprise Architects (VEA) ORM data modeling tool. *[**Note:** IDSc 6431 and IDSc 6432 can be considered as the sequence Database I and Datebase II. This is an update to what is currently listed in the course catalogues. Students are strongly urged to take both 7-week courses because IDSc 6432 provides the opportunity for hands-on working of problems and the solidification of concepts learned in 6431.]*

Instructor: Gordon C. Everest
Semesters offered: Spring

IDSc 6461. Data Warehousing. (2 cr; prereq 6201, MBA student; A-F only)
Exploring the role of data warehouses in supporting decision making in organizations. For those with responsibility for data warehousing initiatives within their organization. Topics include: how data warehouses differ from traditional databases (for transaction processing); extracting and cleansing data from existing operational databases, integrating external data sources, building a historical database; dimensional analysis and multidimensional modeling, the “cube” vs. building the data warehouse in a relational DBMS, designing the STAR schema; online analytical processing (OLAP); data drill down; data mining; the marketplace of vendors and tools to build and use a data warehouse; deploying the data warehouse on the internet and internet access to your internal databases; maintaining the data warehouse as a production system.

Instructor: Gordon C. Everest
Semesters offered: Fall

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LANDSCAPE ARCHITECTURE

College of Architecture and Landscape Architecture
110 Architecture, 612-624-7866
http://www.cala.umn.edu/

Contact: Susan Galatowitsch
305 Alderman Hall
612-624-3242, galat001@umn.edu

Contact: David G. Pitt
125G Architecture Building
612-625-7370, pittx001@umn.edu

LA 5204. Landscape Ecology. (3 cr; prereq B.E.D. accelerated status or LA grad student or #; A-F only)
Relationships among spatial patterns, temporal patterns, and ecological processes in the landscape. Topics include factors affecting landscape pattern, measurement of landscape pattern, material transport through landscapes, effects of landscape pattern on population dynamics, and landscape planning.

Instructor: Susan Galatowitsch Roy L. Rich
Semesters offered: Spring

LA 8203. Making Regional Landscape Space. (6 cr; prereq 8202, grad land arch major, & 8204 or #; A-F only)
Design exploration of landscape ecology, landscape perception, regional economics, and public policy as informants of design decision-making in regional landscapes at or exceeding township level. Geographic information systems as design tools.

Instructor: David G. Pitt
Semesters offered: Fall

LA 8204. Regional Landscape Space. (3 cr; prereq Grad land arch major or #; A-F only)
Theoretical investigations and current advances in use of landscape ecology, landscape perception, regional economics, and public policy as informants of design decision-making in regional landscapes at or exceeding township level. Geographic information systems as design tools.

Instructor: David G. Pitt
Semesters offered: When feasible

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MARKETING

Carlson School of Management
3-140 Carlson School of Management, 612-624-5055
http://www.csom.umn.edu/FacultyDepartments/Departments/MarketingLogisticsMgmt/MarketingLogisticsMgmt.cfm

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Contact: Jane Ebert
3-150 Carlson School of Management
612-624-3998, ebert012@umn.edu

Mktg 6051. Marketing Research. (4.0 cr; prereq MBA 6210, MBA student; A-F only)
Methods for collecting and analyzing data to solve marketing problems Survey research techniques. Research design, secondary/primary data collection, sample design, data analysis. Application of techniques to marketing problems, marketing research projects.

Instructors: Nancy Ebert, Steven Craig Huchendorf, Om Narasimhan
Semesters offered: Fall (Ebert) and Spring (Huchendort and Narasimhan)

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NATURAL RESOURCES AND ENVIRONMENTAL STUDIES

College of Natural Resources
http://www.cnr.umn.edu

Contact: Paul Bolstad
301H Green Hall
612-624-9711, pbolstad@umn.edu

NRES 3031/5031. Applied Global Positioning Systems for Geographic Information Systems (Applied GPS for GIS). (2 cr; prereq Junior standing or higher, some familiarity with ArcView or ArcMap and introductory course in GIS are recommended)
This course covers the principles and fundamentals of GPS and the use of GPS units in the field. Lecture topics will focus on GPS system principles, fundamentals, operations and techniques to improve accuracy. Datum, projections and coordinate systems will be covered. Differential correction and accuracy assessments will be discussed and applied in laboratory exercises. Both code phase and carrier phase GPS will be used in the class and field exercises. Several different types of GPS equipment will be studied in the classroom and used in the field. In addition to traditional GPS handheld units, students will work with PDA based ArcPad/GPS equipment. Students will transfer field data to and from desktop systems and develop skills integrating GPS data with GIS.

Instructors: Andy Jenks and Paul Bolstad
Semesters offered: Spring starting 2004

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PSYCHOLOGY

College of Liberal Arts
N-218A Elliot Hall, 612-625-4042
http://www.psych.umn.edu

Contact: Judy Peterson, Coordinator of Instructional Services
N218 Elliot Hall
612-626-1732, erick005@umn.edu

Psy 3051. Introduction to Cognitive Psychology. (3 cr; prereq 1001)
Scientific study of the mind in terms of representation and processing of information. Research and theory on cognitive abilities such as perception, attention, memory, language, and reasoning. Aspects of computational modeling and neural systems.

Instructor: Chad J. Marsolek or Staff
Semesters offered: Fall (Staff) and Spring (Marsolek)

Psy 5015. Cognition, Computation, and Brain. (3 cr; 3051 except for honors or grads) (3 cr; 3051 except for honors or grads)
Human cognitive abilities, such as perception, memory, and attention, from different perspectives, e.g., the cognitive psychological approach, emphasizing behavioral/functional research, and the cognitive neuroscience approach, emphasizing a theoretical integration of cognitive, neuroscientific, and computational approaches.

Instructor: Chad J. Marsolek
Semesters offered: Fall 2004 (offered alternate years)

Psy 5031W. Perception. (3 cr; 3031 or 3051 or #)
Cognitive, computational, and neuroscience perspectives on visual perception. Topics include color vision, pattern vision, image formation in the eye, object recognition, reading, and impaired vision.

Instructor: Gordon E. Legge
Semesters offered: Fall 2003 (offered alternate years)

Psy 5036W. Computational Vision. (3 cr; 3031 or 3051 or #)
Applications of psychology, neuroscience, and computer science to understanding the design principles underlying visual perception, visual cognition, and action. Compare biological and physical processing of images with respect to image formation, perceptual organization, object perception, recognition, navigation, and motor control.

Instructor: Daniel Kersten
Semesters offered: Fall 2004 (offered alternate years)

Psy 8031. Seminar: Visual Perception. (2 cr; 5031 or #)
Cognitive, psychological, and neurophysiological determinants of visual perception. Current research.

Instructors: Gordon Legge, Daniel Kersten
Semesters offered: Fall and Spring

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PUBLIC AFFAIRS

Humphrey Institute of Public Affairs
300 HHH Center, 612-625-9505
http://www.hhh.umn.edu

Contact: Edward G. Goetz
249 HHH Center
612-624-5003, egoetz@umn.edu

PA 5013. Law and Urban Land Use. (1.5 cr; prereq Major in publ aff or publ policy or sci, tech, and environ policy or urban and regional planning or publ hlth or #; A-F only)
Role of law in regulating and shaping urban development, land use, environmental quality, and local and regional governmental services. Interface between public and private sector.

Instructor: David Sellegren
Semesters offered: Fall

PA 5201. American Cities I: Population and Housing. (4 cr; prereq Grad or #)
Emergence of North American cities; residential building cycles, density patterns; metropolitan housing stocks, supply of housing services; population and household types; neighborhood-level patterns of housing use; housing prices; intraurban migration; housing submarkets inside metro areas; emphasis on linking theory, method, case studies.

Instructor: John S. Adams
Semesters offered: Fall

PA 5202. American Cities II: Economy, Land Use, and Transportation. (4 cr; prereq Grad student or #)
Urban economy and its locational requirements; central place theory; transportation and urban land use, patterns and conflicts; industrial and commercial land blight; real estate redevelopment; historic preservation; emphasis on links between land use, transportation policy, economic development, and local fiscal issues; U.S.-Canadian contrasts.

Instructor: John S. Adams
Semesters offered: Spring

PA 5211. Introduction to Land Use Planning. (3 cr; prereq [Course in spatial analysis or work experience demonstrating knowledge of field], grad student] or #)
Physical and spatial basis for community and regional development processes; issues in design of settlements; applied case studies examining public regulatory frameworks.

Instructor: Unknown
Semesters offered: Spring

PA 5290. Geographic Information Systems for Planning and Policy Analysis. (1-3 cr; prereq Grad or upper level Undergraduate or #; familiarity with Windows 2000 or XP Required; limited to 24 students).
This course introduces students to the capabilities and applications of geographic information systems using ArcGIS 8.2 software. The course gives special attention to spatial problem-solving in urban planning and policy analysis. It includes: (1) gaining skill working with the various tools of the software as well as cartographic and projection basics and database development and management; and (2) working with typical applications involved in planning and policy analysis including: land suitability analysis, location studies, network analysis, U.S. Census analysis, and spatial modeling. The course is offered for seven weeks in the Fall Semester for 1.5 graduate credits. The course features hands-on learning in the Humphrey Institute computer classroom, and also involves homework exercises on the computer as well as a mid-term and final examination.

Instructor: Richard Bolan
Semesters offered: Fall

PA 5722. Environmental and Resource Economics Policy. (3 cr; prereq [Intermediate microeconomics, intermediate policy analysis, grad student] or #)

Public policy associated with natural resource use and environmental protection. Develops/applies economic concepts/methodologies/policy mechanisms. Principles of environmental and resource economics; issues related to renewable/nonrenewable resources and environmental pollution. Focus on scientific and political aspects of policy.

Instructor: Sandra O. Archibald, William K. Easter
Semesters offered: Fall

PA 8201. Environment and Infrastructure Planning. (4.0 cr; prereq [Urban and regional planning] grad student or #; A-F only)
Provides basic knowledge and skills for environment and infrastructure planning practice. Relationship between natural resources, ecology, and urban development, and the planning design principles in balancing these; legal and regulatory context of environmental planning; and methods of environmental impact analysis. Course includes a computer lab using ArcView8.2 GIS software.

Instructors: Richard S. Bolan, David G. Pitt
Semesters offered: Fall

PA 8202. Networks and Places: Transportation, Land Use, and Design . (4 cr; prereq 8212; [Urban and regional planning] grad student or #; A-F only)
Relationship between land use and transportation; development of synthetic design skills for linking land use and transportation in the development and design of urban and regional settlements. Economic, political, legal, and institutional frameworks for such planning. Parallel computer lab and practicum assignment.

Instructors: Kevin Krizek, David Levinson
Semesters offered: Spring

PA 8203. Neighborhood Revitalization Strategies and Theories. (4 cr; prereq [Urban and regional planning] grad student or #; A-F only)
Policymaking and politics of planning in housing, community development, and social policy. Interconnectedness of these policy arenas with reference to local and regional politics. Role of institutional decision-making structures on policy outcomes; importance of citizens, social movements, and interest groups in policymaking process.

Instructor: Edward G. Goetz, C. David Hollister
Semesters offered: Fall .

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PUBLIC HEALTH

School of Public Health
A-302 Mayo, 612-624-6669
http://www.sph.umn.edu

Contact: Brad Carlin
303 Mayo
612-624-6646, carli002@umn.edu

PubH 8436. Spatial Biostatistics. (3 cr; prereq Stat 5101, Stat 5102, some experience with S-plus; [5470 or 8431], Stat 8311 recommended)
Introduces statistical methodologies for analyzing spatial data. Tests for spatial autocorrelation, spatial prediction through kriging, random spatial processes, and tests for disease clustering.

Instructor: Unknown
Semesters offered: When feasible

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SCIENTIFIC COMPUTATION

Graduate School
4-192 Electrical Engineering/Computer Science, 612-625-4002
http://scicomp.cs.umn.edu/

Contact: Phillip J. Barry
4-192 Electrical Engineering/Computer Science

612-624-8310, barry@cs.umn.edu

SciC 8011. Scientific Visualization. (3 cr; prereq Undergrad degree in field using sci comp or #)
Basic issues in scientific visualization, visualization software, graphics, representation of scientific data, modeling, hardware for visualization, user interface techniques, output, commonly used algorithms and techniques for visualization, animation, information visualization, higher dimensional data, case studies, and examples of successful visualizations.

Instructor: Unknown
Semesters offered: When feasible

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SOIL, WATER, AND CLIMATE

College of Agricultural, Food, and Environmental Sciences
439 Borlaug Hall, 612-625-1244
http://www.soils.agri.umn.edu

Contact: Jay C. Bell
570 Borlaug Hall,
612-625-6703, jay.bell@soils.umn.edu

Soil 5515. Soil Genesis and Landscape Relations. (3 cr; prereq 2125 or #; A-F only)
Basic soil morphology and soil profile descriptions; pedogenic processes and models of soil development; soil geomorphology, hydrology, and hill slope processes; digital spatial analysis; soil classification; soil surveys and land use; soil geography.

Instructors: Jay C. Bell
Semesters offered: Fall every year

Soil 5555. Wetland Soils. (2-3 cr; prereq 1125 or 2125 or equiv or #; & 4511 recommended ; A-F only)
Morphology, chemistry, hydrology, and formation of mineral and organic soils in wet environments. Soil morphological indicators of wet conditions, field techniques of identifying hydric soils for wetland delineations. Peatlands; wetland benefits, preservation, regulation, and mitigation. Field trips, lab, and field hydric soil delineation project.

Instructor: Jay C. Bell
Semesters offered: Fall

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Center for Urban and Regional Affairs
(CURA)
330 HHH Center
301—19th Ave. S.
Minneapolis, MN 55455
Phone: (612) 625-1551
Fax: (612) 626-0273

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Home page: *http://www.cura.umn.edu*